ON THE

ANATOMY OF A FIN-WHALE

(PHYSALUS ANTIQUORUM, GRAY)

CAPTURED NEAR GRAVESEND.

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[*From the* PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON,
February 14, 1865.]

In May 1859, my friend Mr. Frank Buckland informed me that a large Whale had been captured in the Thames, near Gravesend; and as we both were desirous of examining such an animal, we at once proceeded to the place in question. It proved to be a fine adult male of the above species.

The history of its capture, as related to us, is briefly as follows:—The gigantic creature, on endeavouring to make its way up the river, had been observed near Thames Haven by some members of the Coast Guard, who attacked and finally succeeded in killing it by inflicting three severe sword-wounds. The body was towed up the river, and hauled ashore in the vicinity of Gravesend, where it was exhibited for some days.

The fleshy parts of the carcase were purchased by Mr. Blaker, an oil-merchant, in order to be boiled down. While the animal was being cut in pieces for this purpose, I had an opportunity of examining the body and viscera, and I obtained some portions which now form preparations in the Museum of the Royal College of Surgeons.

The skeleton was purchased by Mr. George Jones, the proprietor of the Rosherville Gardens, where it is at present exhibited. My thanks are due to that gentleman for his courtesy in allowing me to make a full examination of it.

In the first place, with respect to the dimensions of the animal, the following table expresses certain of the external proportions of the body, measured from the same points as those selected by Mr.

Heddle in his description of a female specimen of *Physalus duguidii* (P. Z. S. 1856, p. 188), which was of nearly equal size.

From these parallel columns the correspondence between the relative dimensions of the two species will readily be perceived.

	Physalus antiquorum.		Physalus duguidii.	
	ft.	in.	ft.	in.
Length from tip of beak to end of tail	60	0	50	0
Head, from tip of beak to centre of orbit (along upper jaw)	11	7	9	5
Head, from tip of beak to centre of orbit (along lower jaw)	13	0	11	3
Centre of orbit to anterior portion of pectoral fin	8	2	5	3
Between dorsal fin and root of tail	10	0	14	0
Girth of body behind the pectoral fin	38	0	23	0
Girth of body at posterior termination of ridges	18	0	19	3
Girth of body at the penis (and close behind dorsal fin)	16	0	11	7

Mr. Blaker estimated the weight of the animal at 45 tons, and was of opinion that about 4 tons of oil might be extracted from the carcase. Thus it would appear that the weight of the *Physalus antiquorum* is inconsiderable, when compared with that of a *Balæna mysticetus* of equal length—the probable weight of the latter, according to Scoresby*, being 70 tons; and of this he allows 30 tons for the blubber alone.

With regard to colour, the head and back were black; the chest and throat of a brownish shade, and having the usual plaited character of the *Balænopteridæ*. Some of the crests of the ridges were deep brown, with the grooves or furrows of a lighter hue, even to yellowish white; other ridges had light-coloured crests, with their corresponding furrows greyish black. From the posterior termination of these folds backwards the skin was yellowish white. The pectoral fins were dingy black above, whitish beneath, as also was the skin of the body beneath their bases; this was most marked behind, where the whitish colour was continuous with that posterior to the ridges.

In the specimen of *Physalus* minutely described by Mr. Heddle (P. Z. S. 1856, p. 193), after mentioning that the back is black, with some grey spots, and the belly white, he further says, "When viewed obliquely, on the other hand, the whole dark portion of the animal seemed a dull leaden grey—a deception arising, no doubt, from the refraction of the light from the polished surface."

In the present specimen I observed something similar, which I am inclined to believe was caused by the fact that the epidermis consisted of several layers—the deeper and thicker intensely black, but the more delicate and superficial of a much lighter greyish brown hue, allowing, however, under certain circumstances, the deep black colour to show through, at other times reflecting its own paler tint.

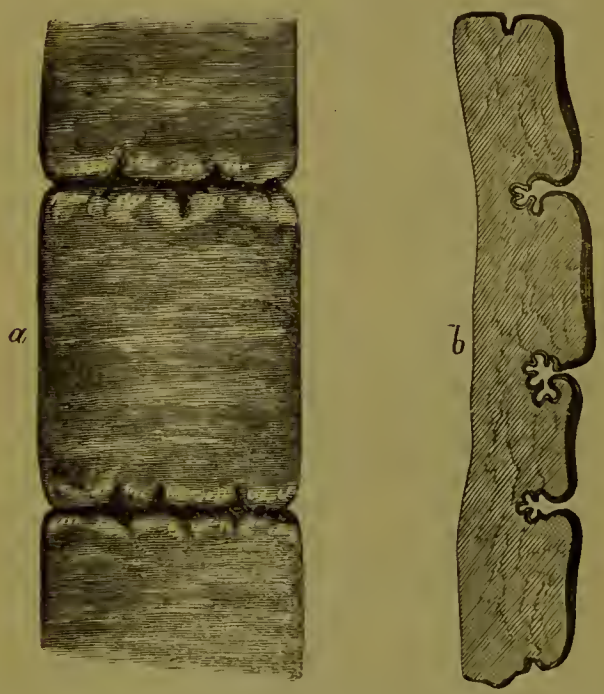
Of the parallel ridges with their corresponding furrows I counted on the one side as many as between forty-five and fifty, which would

* 'Arctic Regions,' Edinb. 1820, vol. i. p. 462.

give a total of somewhere about one hundred. Although parallel to each other and to the long diameter of the body, they were not in perfect straight lines, but adapted themselves to the curve of the throat and chest, being shortest as they ascended towards the back. They commenced a short distance from the mouth or lower lip, and did not extend quite so far back as the penis.

The breadth of each of these folds varied from 2 to 5 inches, and their height was about an inch. The interspaces or furrows were one or more inches wide, according to the manner in which the part was stretched. Here and there these plications joined each other at acute angles.

Fig. 1.



a. Skin, showing larger-sized folds, with intervening furrows and wrinkles.
b. Vertical section through four of the smaller ridges and grooves.

A vertical section of the skin showed that the crown of each ridge had a thick cap of hard cuticle covering it, and which was of greatest depth at its centre, shelving off on either side (see fig. 1 *b*). The furrows themselves were lined with thinner soft cuticle, and, as best seen in the smaller grooves, they became widened at the bottom, where the skin was raised in several puckerings or folds. These last, as well as numerous wrinkles of the free edges of some of the ridges, no doubt admitted of the easy distention of the parts. The woodcuts (fig. 1 *a* and *b*), drawn from nature, show these several points. Heddle has given a couple of linear diagrams to illustrate

the mode of distention of the skin of the animal he dissected (P. Z. S. 1856, p. 192, pl. XLV. f. 8); but these will be found on comparison hardly to show the true manner in which distention is permitted.

A similar vertical section through the skin, as deep as the muscle, revealed the small depth of the blubber, from 2 to at most 4 inches, and that between it and the true skin there was scarcely any appreciable difference, so intimately and continuously were the fibres interwoven. The only difference was in the rather wider meshes inwardly, the interspaces there containing oil, although in very limited quantity.

The pectoral fins were flattened, narrow-pointed, and curved; in appearance they were not unlike the figures given by Eschricht* of the fin of *Pterobalæna minor* (*Balænoptera rostrata*, Fab.).

In position, and while attached to the body, one measured along the border of the anterior curve 75 inches, and in the posterior marginal curve 57 inches. When cut off, the measurement from the articulation of the shoulder-joint to the terminal point in a direct line was 85 inches.

The dorsal fin was falciform, laterally compressed, and erect; its height 15 inches, and its antero-posterior length at the base 13 inches.

The tail in extent across to the extremity of either fluke was 133 inches, and its breadth at the root 37 inches.

I am not aware that the exact manner in which the tail acts in this tribe of animals is perfectly agreed upon among writers; for although John Hunter† expresses himself to the effect that the motion of the tail is similar to that of an oar in sculling a boat, and again, that from its horizontal position the animal is impelled up and down in the water, thus giving the necessary opportunity of breathing, yet Dr. Knox‡ admits the difficulty in understanding the mode of progression, and further states that this takes place by a series of bounds, caused by the spring of the incurved tail, the immense strength of the flexors and extensors giving it such a counter force against the water as to impel the animal along and upwards according to circumstances.

That each of these mechanical applications of the tail to certain motions does take place is more than likely, although at first it does not seem so very clear how the mere flapping of a horizontal tail produces a steady onward gliding movement, which no doubt occurs without the necessity of continually rising and falling in the water.

The Sperm Whale, according to Beale§, "when undisturbed, passes tranquilly along just below the surface of the water, at the rate of about three or four miles an hour, which progress he effects by a gentle oblique motion from side to side of the 'flukes,' precisely in

* Untersuchungen über die Nordischen Wallthiere, 1849, tab. 8. figs. 1, 2.

† 'Observations on the Structure and Economy of Whales,' Palmer's edition of his works, 1837, vol. iv. p. 331.

‡ 'Cat. Prep. of Whales,' No. 4. I am indebted to the kindness of Dr. Gray for a perusal of this scarce pamphlet, which contains much information on the anatomy of Cetacea.

§ 'Nat. Hist. of the Sperm Whale,' p. 39.

the same manner as a boat is sculled by means of an oar over the stern. . . . . When desirous of proceeding at a greater rate, the action of the tail is materially altered; instead of being moved laterally and obliquely, it strikes the water with the broad flat surface of the flukes in a direct manner upwards and downwards."

The first part of Beale's description seems to me pretty well to explain the manner of action of the tail in gentle forward movement; for if we take it as a mere dynamical agent, then, according to the law of forces, the lobes of the tail, striking the water between the horizontal and vertical, would cause the body of the animal to move in the diagonal of these*. We have then to consider if the lobes do strike the water in this oblique manner.

In illustration of its probability, I may mention that in this specimen I noticed that as the lobes of the tail began to dry by the heat of the atmosphere they assumed opposite concavo-convex curves, so as to produce a very close resemblance both in curve and angle to the blades of a screw propeller. If this is what usually takes place in the movement of the tail, then one can readily understand that in the act of striking downwards and upwards with but a very slight lateral movement the water would receive an oblique stroke between the horizontal and vertical; in fact it would produce a more or less scooping, spiral, screw-like action, the consequence of which would be movement in the diagonal of the parallelogram of the resisting forces, from side to side, above downwards and below upwards.

As a further demonstration that something like this occurs, I may state that I observed in the mode of progression of the Porpoise lately exhibited in the Society's Gardens a movement in the tail more or less resembling this. As the creature swam horizontally, and within a short distance of the surface, it struck the water up and down, but with an inclination of the lobes to the one or other side, adding to the obliqueness of the stroke by rolling its body slightly, so that the tail struck the water rather slantingly than directly up and down. When simply raising itself towards the surface (as, for instance, in breathing), or in descent, then the stroke seemed more flat, and the body, along with the tail, bent in a curve according as the movement was elevation or depression.

In *Physalus*, the arch of the mouth, both antero-posteriorly and transversely, is much less than in the true *Balænæ*; the length of the whalebone is also correspondingly shorter. In our specimen of *P. antiquorum*, the transverse curve of the former was about 72 inches at its widest, that is including the bony palate and the filaments of whalebone on either side; but towards the beak it became flattened and so narrowed that the chord of the arch was but 10 inches. The free palate itself in the middle of the mouth had a breadth of 12 inches.

The outward exposed parts of the baleen *in situ* on one side measured from the beak to the angle of the mouth in a direct line 126

* See article "Motion," 'Cyclop. Anat. and Physiol.,' vol. iii. p. 438.

inches; after removal from the jaw, and taken along the great curve of its free brush-like margin, the length was 169 inches.

On the left side I counted 360 of the outer baleen-plates. The greatest length of a single one was 30 inches, the breadth of the same 11 inches; towards the beak, however, the baleen altered into mere hair-like bristles only 5 inches long, and which were continuous with the baleen of the opposite side. Knox, in his dissection of *Balæna maximus* (*P. antiquorum*), counted 314 external or labial plates of baleen on each side; and he gives as the measurements of the largest one, 26 inches in length and 15 in breadth*. The soft, broad, fleshy nidus of the baleen, in apposition with the upper jaw, tapered at each end, and altogether had a length of 149 inches. The results of a series of its transverse measurements, made from behind forwards, were as follows—viz., at the extreme posterior end, 6 inches, then 8, and at widest 14 inches, narrowing from this to 7, and at the most anterior portion only 1 inch across.

The œsophagus was certainly 7 feet, possibly 8 feet long. The closed fist could be passed with ease through any part of its course: one portion had an internal circumference of 9 inches. In some places there were numerous glandular openings, each sufficient in size to admit a pin's head, and aggregated together, forming elongated diamond-shaped patches. Upon the surface of the mucous membrane, in irregular quantities, were scattered, rough, warty-like, whitish bodies, equal in size to millet-seeds. This might have been a pathological condition.

The stomach consisted of four separate cavities, communicating with each other by round, somewhat constricted openings, as in the Porpoise. I did not, however, ascertain the exact position these cavities bore towards each other *in situ*; but I made a rough sketch of the whole when removed from the body and cut open, which is represented in the accompanying woodcut (fig. 2).

The first cavity, a large globo-pyriform bag, had a greater curvature measuring 99 inches, and an upper lesser curvature of 30 inches. The opening of the œsophagus and that leading into the second cavity were each 15 inches in circumference, and situated on opposite sides of the lesser curvature. The mucous membrane towards the greater curvature had its rugæ thrown into polygonal folds, which above dwindled into mere puckerings. This stomach contained some cream-coloured, gelatinous, glairy fluid and fragments of *Medusæ*, as also what I took to be remnants of *Entomostraca*.

The second cavity was more cylindrical in form, and of considerable length—97 inches. The plications of its mucous membrane followed its long diameter, and these were in thicker ridges than in the first cavity. There were no evident remains of food in this division of the stomach; at the same time its mucous surface was reddish and partly covered with a brown slimy substance.

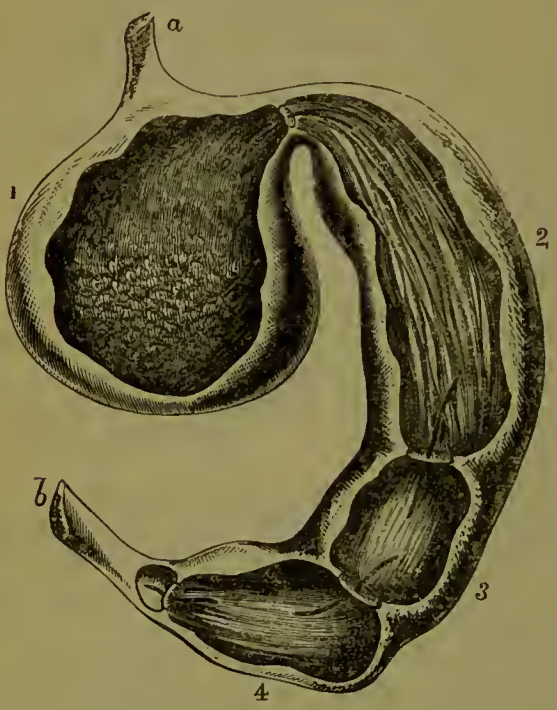
The third cavity was shorter than either of the preceding ones, and a trifle less so than the fourth. It was 30 inches long, with a

* Cat. Prep. Whales, No. 8.

eireumferenee of 24 inehes, and somewhat of a barrel-shape within. The mueous rugæ were in bands, extending transversely to its long diameter, and of a pinkish hue. It likewise was empty.

The fourth eavity was just 2 inehes longer than the one before and of a similar shape, its eireumferenee 25 inehes, eontraeting at the intestinal outlet to 14 inehes. It had no visible eontents; the mueous membrane was stained of a yellowish biliary eolour.

Fig. 2.



Stomach: 1, 2, 3, 4, the first, second, third, and fourth eavities; an indicator is passed through the contracted orifices of each. *a.* Œsophagus; *b.* Small intestines.

The small intestines commeneed by a narrowing of the last stomaeh, the pylorie orifiee being surrounded by a fold of mueous membrane. They eontinued with an approximate eireumferenee of from 7 to 11 inehes for a total length of 248 feet. The intestines were void of eontents, exeept a sprinkling on their surfaee of a white powdery-looking substanee. The mueous membrane was of a yellowish-red tinge; its folds were of two kinds, the one in longitudinal fringes, erossed by innumerable transverse ones, the whole forming a series of eavities of two sizes. The average size of the one kind of these eavities was 6 inehes by 2, of the other, the smaller-sized, from 2 to 3 inehes in the one direetion, and in the other but one-half that size, while the free fold itself had a general depth of from 1 to 2 inehes.

Esehricht* has described and figured a singular arrangement of the mucous folds of the intestine in *Megaptera longimana*, which is very similar to the above; besides, he also figures a still more curious pouch-like character in the *Hyperoodon*†. John Hunter‡ had previously described this structure in the *Hyperoodon*; and he remarks that "in the Bottlenose the inner coat, through nearly the whole trace of the intestine, is thrown into large cells, and these again subdivided into smaller, the axis of which cells is not perpendicular to a transverse section of the intestine, but oblique, forming pouches with the mouths downwards, and acting almost like valves when anything is attempted to be passed in a contrary direction." Admirable preparations of the same exist in the collection at the College of Surgeons (Physiol. Series, nos. 709–712).

The opening of the hepatic duct was immediately below the junction of the last cavity of the stomach with the small intestines.

The accurate entire length of the large intestines was not ascertained; but as the first piece examined measured 22 feet 2 inches, and another portion 10 feet, it may reasonably be inferred that the total length was little, if at all, short of 40 feet. The cæcum was of moderate dimensions, with an internal circumference of $15\frac{1}{2}$ inches. The folds of its mucous membrane were placed transversely, and each had a depth of from 2 to 3 inches; these continued onwards to the colon and rectum, where they were not so large or closely set together. Yellow-coloured fæces filled in great part the colon and rectum; and over the mucous surface of these, small oval-shaped entozoa (*Echinorhynchus*?) swarmed in myriads.

Circumstances prevented the larynx from being very carefully examined; its measurements were as follows:—

	inches.
Internal circumference a foot below its chink	$39\frac{1}{2}$
Internal circumference at the epiglottis	$42\frac{1}{2}$
Across the base of the epiglottis itself	13
Opening of the vocal cords antero-posteriorly	12
Opening of the vocal cords transversely at anterior end	7
Opening of the vocal cords transversely at posterior end	3
Trachea immediately above bifurcation, behind forwards	10
Trachea immediately above bifurcation, transversely	15
Trachea, fibro-elastic tissue behind cartilages	5

The heart agreed closely with that of ordinary mammals, varying only slightly in the number and disposition of the chordæ tendineæ. As it lay on the ground it measured from base to apex 32″; breadth at middle 35″, and at the base 42″. The different segments of the semilunar valves were 9″ by 7″ in dimensions respectively. There were no corpora aurantii. The aorta 27″ in circumference; the walls nearly an inch thick. The ductus arteriosus existed as a thick roundish elastic cord placed a little obliquely in relation to the pul-

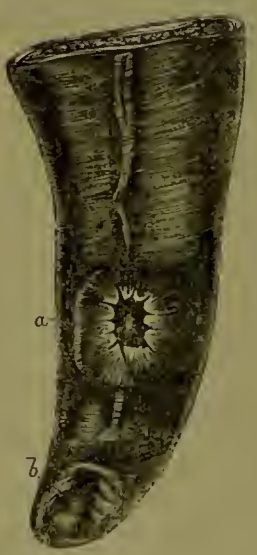
* *Loc. cit.* p. 100, tab. 2. figs. 3 & 4.
† Ibid. p. 42, tab. 2. figs. 3 & 4,
‡ *Loc. cit.* vol. iv. p. 361.

monary artery and aorta; longer above than below, on account of the divarication of these vessels. Length of its upper border $3\frac{1}{2}''$, of the lower $2''$; circumference $7''$. Its canal was sufficiently closed to prevent the passage of blood, by reason of the elasticity of the walls; but a probe the thickness of a quill could be pushed through the entire distance.

The kidneys, lobulated, had each lobule averaging the size of a plum. One kidney was 60 inches long by 17 broad, the other 66 inches by 15, both elongated and oval-shaped, their extremities decreasing to a transverse diameter of 8 inches.

As is usual in Cetacea, the penis was conical; and when we examined the animal, it was not retracted, but hung loosely from the abdomen. In length it was 48 inches; at its widest, circumference 25 inches, tapering to less than two at the point. At this last the termination of the canal of the urethra opened rather on the under surface (fig. 3 *b*); the opening was crescentic, with the horns forwards, and on the roof a slightly depending ridge of mucous membrane. Behind this, at the distance of $1\frac{1}{2}$ inch, existed a second opening into the urethra (fig. 3 *a*), subcircular in form, nearly equal in size to the first, and with indented edges. Around this, for almost the size of a shilling piece, the cuticle exhibited a minute linear-rayed appearance, not unlike certain forms of cicatrices. From the internal lining of the opposite surface of the mucous membrane a nipple-like process protruded, dividing the canal as it were into two passages. This projection appeared to be part of a longitudinal ridge of the mucous membrane, extending along the roof of the canal of the urethra.

Fig. 3.



Whether this very unusual second perforation of the urethra was normal, or only the result of injury or of pathological origin, I will

not pretend to state with certainty, although I am inclined to believe it to have been of the latter nature; nevertheless I have thought it of sufficient import to be figured, so that the attention of future observers may more readily be called to notice if such a structure exists in any specimen that may be dissected by them.

Transverse sections of the penis at various points showed, as in ordinary Cetacea, the usual absence of median division in the corpus cavernosum; at the root, however, there was an approach to separation by the aggregation of the vessels into two circular groups; but towards the anterior extremity or point these were scattered more equally among the strong fibrous trabeculæ. The canal of the urethra for its whole length was on the under side of the corpus spongiosum: in this respect it differed from that of the Porpoise, which Hunter (*loc. cit.* p. 388) has described as being at first in its centre, and then coming to be on its under side. At the root the canal was roundish, but towards the free extremity more triangular in form. The strong, firm, fibrous sheath surrounding the corpus cavernosum was an inch thick in most parts. The glans penis was represented, for a considerable distance backwards, by a thick layer of vessels, chiefly veins, each, on section, of a slit-like shape, with pointed ends, and arranged with their broad surfaces superimposed upon one another on the fibrous sheath, excepting on its under side. Their appearance in the transverse section was not unlike the open vascular sinuses of a pregnant uterus when cut vertically.

The foregoing are the principal observations which I had the opportunity of making on this specimen while in the fresh condition; but I think it may be as well to add some notes on the osteology, as a contribution towards a fuller knowledge of its anatomy. This subject has already been partially treated by Cuvier, Van Beneden, Dr. Gray, and others; but so much remains to be done to complete the anatomy of species of the group, that any details as to the structure of a single individual can hardly be deemed superfluous.

Mr. Flower has made some original and highly useful observations on the condition of the bony epiphyses as a guide to age in the Cetacea (P. Z. S. 1864, p. 384); and, availing myself of his remarks, I agree with him in classing the Rosherville specimen of *Physalus antiquorum* in the third or last stage, that is, a perfect adult, although the animal was no more than 60 feet long. For, on examination, I find all the epiphyses of the vertebræ are firmly anchylosed, so much so that the line of junction is with difficulty made out. The same may be said of the upper and lower epiphyses of the humerus. The proximal epiphyses of the radius and ulna are likewise firmly adherent to the shaft by bony union; but, on the other hand, the distal epiphyses of these bones are only united at their periphery, for a broken portion in each discloses the centre to be incompletely ossified, and not attached to the diaphysis of the bone. The sutures of the skull are also well-nigh obliterated, excepting such as remain more or less persistently separable.

The general appearance of the skull shows no points strikingly different from what is usually found in *P. antiquorum*; and the

figure given by Eschricht and Reinhardt* of the skull of *Balænoptera musculus*, J. Müll. (=*Physalus antiquorum*, Gray) may be said to convey a fair idea and representation of it.

The two outer borders of the superior maxillaries at the base of the beak run nearly parallel for about their posterior half, whence they incline gently towards each other; but in the anterior fourth they approach more quickly to the narrowed tip of the beak. The nasal processes of the same bones are flattish, and at the nasal fossa have a sharp internal edge; but on reaching the posterior end of the premaxillaries they slope outwards and downwards, forming the posterior superficial curve of the rostrum; at the tip of the beak, however, they again become nearly horizontal.

The premaxillaries, on the other hand, at their posterior ends are almost vertical, and look towards each other in the nasal fossa, while they become horizontal in the middle of the beak, and shelve outwards at the tip. The frontal bone in the median line of the skull is represented merely by its nasal tuberosity, which is wedged in behind the nasal bones; but the orbital plates occupy a great flattish expanse on either side, and look directly upwards. The cavity of the orbit is ovoid, with a height of $7\frac{1}{2}$ and a breadth of 10 inches.

The malar bones are present, flattened, and of a comparatively small size; their maxillary process is broader than their zygomatic. The prominence of the cranium formed by the supra-occipital presents a very slight concavity, with just an appreciable median ridge. Posteriorly the occipital region shelves sharply downwards and backwards, and has a considerable concavity. The occipital foramen and condyles are directed straight backwards. This posterior occipital inclination does not seem so sharply defined in the young skull of a *Physalus antiquorum* in the Museum of the College of Surgeons (no. 2446 A, Osteological Series). The vomer reaches within a foot of the anterior tip of the premaxillaries; along with the superior maxillaries, it forms a marked palatine ridge in the roof of the mouth.

The inferior maxillary bones have acuminated coronoid processes, which are bent outwards at their extremities. The condyles are set backwards and a little outwards, externally overlapping the groove of the neck. The rami are strong and with a moderate lateral curve.

The following are a series of measurements of the skull, taken in inches, and in the manner followed by Mr. Flower (P. Z. S. 1864, p. 411); so that the dimensions of the cranium of this specimen may readily be compared with the examples of *Physalus antiquorum* given in the above paper.

	inches.
Length of skull in straight line	168
Breadth of condyles	12
Breadth of squamosals (greatest breadth of skull)	82
Orbital process of frontal, length	30
Orbital process of frontal, breadth at base	$25\frac{1}{2}$
Nasals, length	$8\frac{1}{4}$

* Om Nordhvalen, 1861, tab. 3. fig. 3.

	inches.
Nasals, breadth of the two at posterior end	4¼
Nasals, breadth of the two at the anterior end	7
Length of beak, from curved border of maxillary to tip	116
Length of maxillary	132
Projection of premaxillary beyond maxillary	6¼
Breadth of maxillaries across orbital processes, following curve	81
——— of beak at base, following the curve	55
——— of beak, one-quarter of its length from base	42
——— of maxillary at the same point	14
——— of premaxillary at the same point	6½
——— of beak at middle, following the curve	33
——— of maxillary at middle	10
——— of premaxillary at middle	5¼
——— of beak at three-fourths of its length from base	23
——— of maxillary at same point	5½
——— of premaxillary at same point	5½
Length of lower jaw in a straight line	156
Height at coronoid process	19
Height at middle	12

The total number of the vertebræ present is 58; but evidently a few of the terminating caudal are wanting. The vertebræ are as follows:—7 cervical, 15 dorsal, 15 lumbar, and 21 caudal. The cervical, as usual in this Whale, are all free. The atlas is similar to that of an animal of the same species from Devonshire, figured by Dr. Gray in his recent paper on the "British Cetacea" (Proc. Zool. Soc. 1864, p. 217, fig. 9), and answers well to his description, except that the transverse processes are somewhat more horizontal, bulbous, and truncated at their outer ends. It may further be remarked that Dr. Gray's figure of the atlas of *Physalus duguidii* (*loc. cit.* p. 220, f. 13) agrees rather with the Rosherville specimen.

The axis does not quite agree with either of the figures given by Dr. Gray of species of this genus (*loc. cit.* figs. 10 & 14); but, of the two, the resemblance is greater to the Devonshire specimen of *P. antiquorum*; the perforations of the lateral processes, however, are rather larger and more oval. The rudiment of an odontoid process exists in a raised, flattened, circular prominence. The expansions of the transverse processes point backwards, and reach so far as to enclose those of the three succeeding vertebræ; they are thin towards their free outward extremities. The neural arch is broad, and its laminæ prolonged; so that it projects in a shelving manner over the next vertebra. The spine is bifid, and the prominences on either side are strong and massive, while the median groove is marked by a slightly raised ridge.

The third vertebra is thinner in every way; in this respect it agrees with the fourth and fifth. The body is tolerably square, less deep than broad; the anterior articulating surface single and convex, the posterior broadly concave; the transverse process ring-shaped, compressed antero-posteriorly, and with a backward-arched curve,

very thin at the tip. The perforation is bluntly heart-shaped, with the apex outwards; the upper and inner angle sharpest, curving round the body more than in the lower one. The neural spine is only indicated by a central ridge.

The fourth is very similar to the third. The transverse process is not so sharply bent backwards, but it is slightly wider; the bony ring is broader and thicker. The fifth agrees in general with the preceding; its transverse process is a little longer than in the fourth, the lower bone of the ring less curved, broader, and with a wider expansion at its inferior angle. The neural arch diminishes in breadth, but the spine is more prominent. Dr. Gray's figure of the fifth cervical vertebra of *P. antiquorum* (P. Z. S. 1864, p. 217, fig. 11) does not quite correspond to the one under description: what he gives as that of *P. duguidii* closely resembles our specimen, except that the lateral processes do not form a complete ring.

In the sixth the body is thicker and flatter; the abutments of the ring of each lateral process do not pass outwards perpendicularly to one another, the upper being in advance of the under; the lower is also much thicker. The perforation assumes more the shape of an equilateral triangle than in the third, fourth, and fifth. On the right side its processes of bone are not completely united, being apart from each other for about the extent of an inch; the edges taper towards each other in such a manner as to show this to be a natural deficiency, and not caused by injury. The neural arch is broad, biconcave behind, and overlapping the next vertebra as in the other cervical.

The seventh cervical, in some respects, makes an approach to the first dorsal vertebra. It has a thicker and rounder body than the sixth cervical. The lateral process is not developed below, being merely indicated by a slight tubercle on the body of the vertebra. The single transverse process is directed almost straight outwards from the body; it is thick and strong, broadest and compressed from before backwards at the tip. The spine of the neural arch begins to be prominent, pointed upwards and a little forwards.

Comparative Measurements of the Cervical Vertebræ, in inches.

No. of vertebra.	Greatest width, between extreme points of transverse processes.	Greatest width of body.	Greatest height of body.	Thickness of body.	Length of transverse process.	Greatest vertical width of transverse process.	Foramina of transverse process, greatest width laterally.	Foramina of transverse process, greatest height vertically.	Neural spine, greatest height.	Neural spine, greatest breadth antero-posteriorly.
1st	24	11½	10½	3 to 4	4½	3	..	..	1	4¾
2nd	42	14	9	2¾ to 4	18	10	7½	3¼	4	5
3rd	32	12	8¼	2¼	12	10	8¼	6	¼	3¼
4th	33	11½	..	2¼	12	10	8¼	6	¼	3¼
5th	35	11	..	2¼	12	9	8¼	6¼	¼	3¼
6th	32½	11	8	2¾	12	9	8¼	6½	¼	3¼
7th	30	11	7¾	3	10½	1½	..	..	1½	2½

The fifteen dorsal vertebræ have not such varied characters as the cervical. Their bodies are large, thick, and cylindrical, tolerably equal in size, the average height being about 8 inches, with a width of 11¼ and a thickness or antero-posterior extent of 11 inches; the articulating surfaces are flattened. The transverse processes come from the upper portion of the bodies. Excepting the few first, these are thin, broad, straight, and flattened from above downwards; slightly narrowed at their necks, widening and thickening at the outside free margins, which are curved and hollowed according to the extent of indentation or groove for the attachment of the rib.

The laminæ forming the arch are broad (particularly in the front vertebræ), and meet rather high, at an acute angle, forming a large triangular cavity for the spinal cord. The spinous process is of considerable size, averaging 11 inches in length and 7 inches in breadth, rather widest at the truncated extremity. Among the first dorsal vertebræ it is inclined forwards, in those further behind sharply backwards, and in the few last so much so as to rake far behind the body. In the anterior vertebræ the metapophyses of Owen* arise from the body, where the lamina and transverse process meet, but in the posterior vertebræ from the lamina alone. They are narrower at their necks than at their free extremities, and have a direction upwards and forwards. Their average height and breadth is from 4 to 5 inches.

Series of Measurements to illustrate the comparative Dimensions of the Dorsal Vertebræ, in inches.

Dorsal vertebræ.	Greatest width, between extreme points of transverse processes.	Greatest height, from base of body to tip of neural spine.	Greatest width of body.	Greatest height of body.	Greatest thickness of body.	Length of transverse process.	Breadth of transverse process at neck.	Breadth of transverse process at tip.	Breadth of neural spine at tip.	Breadth of neural spine at base.	Height of metapophyses.	Width of metapophyses.
1st....	32	14¼	11¾	7½	3½	12	2	1¼	4	..	½	1¼
3rd ..	28½	18½	12½	7½	5½	10½	3½	5	5¼	..	3¾	1½
5th ..	31½	22½	11½	7¾	6¾	11¼	4½	6	7	..	1½	2¼
7th ..	32½	23¼	10¾	8	7¼	13½	4½	7½	8	6	4	4¼
9th ..	39	23¾	11¼	8½	8¼	13¼	5	7¾	8¼	5¾	5	5
11th ..	39½	24	11½	8½	8½	14	5	7¾	7½	6	5½	5½
13th ..	39½	24¼	11¼	9	8½	14	5¼	7½	8	6	5	5¾
15th ..	34½	23	11½	8¼	8¾	14¾	5¼	8	8¼	6½	5	5

The most striking differences in the dorsal vertebræ are as follows:—In the first the transverse process is compressed antero-posteriorly, as in the seventh cervical; the articulation for the rib is at its outer extremity, and inclined towards the under surface. In the second the neural spine is large, triangular, the apex pointing forwards and upwards. The metapophysis begins to be of marked di-

* See Prof. Owen's article "On the Megatherium," Phil. Trans. 1851, p. 739.

mensions. The articulating facet for the second rib is on the under surface of the transverse process. In the third the neural spine is more blunted than in the second; the transverse process becomes flattened from above downwards, not before backwards as in the two first. The fourth dorsal has a broader truncated spine looking directly upwards; its transverse process is completely flattened, but thick at the outer point for the attachment of the rib. The remainder of the dorsal vertebræ differ so little from each other as not to require any special notice.

The lumbar vertebræ present few special differences from the dorsal, only varying somewhat in the proportions of their several parts. The average thickness of the body in each is about $9\frac{1}{2}$ inches, but in the last five it is an inch more. The same might be said of their height, while their width is above 12 inches. The spinal canal is lessened in size towards the last. The neural spine slopes rather more backwards than in the dorsal, its truncated extremity is straight and looking directly upwards; but in the last one the truncation is more oblique, the posterior angle of the spine less inclined upwards, but more backwards and downwards. The metapophyses at first are subquadrate, and arise from the base of the neural laminæ; but in the more posterior vertebræ they become conical, are given off higher, and, instead of a direction forwards, rather come to point upwards. The transverse processes are very uniform, flat, thin, straight, and of nearly an equal breadth throughout. Their average length is 14 inches, diminishing to 12 inches in the five hinder vertebræ; and their breadth is at narrowest 5 inches, increasing outwardly to 8 inches.

Series of Measurements to illustrate the comparative Dimensions of the Lumbar Vertebræ, in inches.

Lumbar vertebræ.	Greatest width, between extreme points of transverse processes.	Greatest height, from base of body to tip of neural spine.	Greatest width of body.	Greatest height of body.	Greatest thickness of body.	Length of transverse process.	Breadth of transverse process at neck.	Breadth of transverse process at tip.	Length of neural spine.	Breadth of neural spine at base.	Breadth of neural spine at tip.	Height of metapophyses.	Width of metapophyses.
2nd ..	$41\frac{1}{2}$	25	$11\frac{3}{4}$	$8\frac{3}{4}$	$9\frac{1}{2}$	$14\frac{3}{4}$	$4\frac{3}{4}$	$6\frac{3}{4}$	$13\frac{1}{2}$	$6\frac{1}{4}$	$9\frac{1}{4}$	$4\frac{3}{4}$	$4\frac{1}{2}$
4th ..	42	25	12	9	$9\frac{1}{4}$	$14\frac{1}{2}$	5	8	13	6	$9\frac{1}{4}$	$4\frac{1}{2}$	5
6th ..	40	26	$12\frac{1}{4}$	10	$9\frac{1}{2}$	14	$5\frac{1}{2}$	$8\frac{1}{4}$	14	$5\frac{1}{2}$	10	$3\frac{3}{4}$	$4\frac{3}{4}$
8th ..	39	25	$12\frac{1}{2}$	9	$9\frac{3}{4}$	14	$5\frac{1}{4}$	8	$13\frac{1}{4}$	$6\frac{1}{2}$	$9\frac{1}{2}$	$3\frac{1}{4}$	$5\frac{1}{4}$
10th ..	$38\frac{1}{2}$	$25\frac{1}{2}$	$12\frac{1}{2}$	10	$9\frac{3}{4}$	$12\frac{1}{2}$	$5\frac{1}{2}$	$7\frac{1}{2}$	$14\frac{1}{2}$	6	$9\frac{1}{4}$	$3\frac{1}{4}$	6
12th ..	36	$24\frac{1}{2}$	$12\frac{1}{2}$	$10\frac{3}{4}$	10	$12\frac{1}{2}$	$5\frac{1}{2}$	$8\frac{1}{4}$	14	6	9	$2\frac{3}{4}$	$5\frac{3}{4}$
14th ..	30	$28\frac{1}{2}$	13	$10\frac{1}{2}$	$10\frac{1}{2}$	..	..	..	14	$6\frac{1}{2}$	9	$3\frac{1}{4}$	5

The caudal vertebræ present are twenty-one in number. The three most anterior of these are chiefly distinguished from the last lumbar by the attachment of the chevron bones; but those behind by degrees alter in form till at length there remains only a small

roundish body without processes. This general alteration commences by the neural spine decreasing in length and breadth, and likewise by the transverse processes becoming very much shortened, at the same time broadened and with a direction pointing forwards. While also the neural spine diminishes, it is set more slantingly backwards, and the metapophyses (Owen), which in the anterior vertebræ are in comparison insignificant in size, assume extravagant proportions, and ultimately in the posterior vertebræ are the largest of the two; they shift their position so as to reach the summit of the neural laminæ, and towards the last actually take the place of the neural spine.

The bodies of the first twelve caudal vertebræ are rather increased in depth below, the transversely ovoid form in the lumbar being here more triangular or carinated ventrally.

The special differences among the caudal vertebræ are in the first to the fifteenth having parapophyses and facets for the attachment of the chevron bones. In the fourth the neural spine shortens very considerably; the metapophyses are strong and point upwards; the lower groove in the body is deepened, and there are four parapophyses, the two posterior having articulating facets. From the seventh to the eleventh vertebræ there is a wonderful decrease in the size of the neural spine and transverse processes, which latter are reduced to a mere ridge in the eleventh; these last have all, nevertheless, a perforation through them. In the twelfth, thirteenth, and fourteenth vertebræ the neural spines diminish to little better than mere prominences, the metapophyses being the larger of the two. The parapophyses (two from each body) are perforated laterally at the middle. The transverse proeesses are only indicated by a slight elevation of the bone, which is pierced by a small foramina in the twelfth and thirteenth; but in the fourteenth this is altered to a groove. The fifteenth, sixteenth, and seventeenth present only ovoid or compressed discoidal bodies, proeesses or prominences being wanting; on their outer sides, however, there are scattered several large foramina. In the remaining vertebræ, which include the eighteenth, nineteenth, twentieth, and twenty-first caudal, the minimum of size is reached. Their bodies are short, thick, and somewhat quadrangular, with no processes, though in the last there is a slight prominence on its neural aspect. Besides a lateral depression and perforation, they have on the under surface a single central foramina; this exists from the fifteenth vertebra on till the twenty-first, where there are two.

Series of Measurements to illustrate the comparative Dimensions of the Caudal Vertebræ, in inches.

Caudal vertebræ.	Greatest width, between extreme points of transverse processes.	Greatest height, from base of body to tip of neural spine or metapophyses.	Greatest width of body.	Greatest height of body.	Greatest thickness of body.	Length of transverse process.	Greatest breadth of transverse process.	Length of neural spine.	Breadth of neural spine.	Greatest height of metapophyses.	Greatest breadth of metapophyses.
1st.....	28	30	12½	11½	10¼	7	6½	14	6¾	4¼	3¼
3rd	26	27½	12½	12	10½	6	6¼	12	5	4	3½
5th	23½	22½	13	12¼	10½	5	5½	7	3¾	3½	3½
7th	18	20½	13	11¼	10½	4	7	6	2½	4	4
9th	15	19	13	11¼	10	2¼	6	3½	2	3½	3½
11th	12½	15½	11½	10⅓	9	1½	5	3	1	2¾	2½
13th	10	14	10	10½	8	½	3	1¾	1	2¼	2

The bodies of the remaining caudal vertebræ are as follows :—

	Greatest width.	Greatest height.
16th	7¾	3¾
17th	7½	3½
18th	6	3¼
19th	5	3
20th	4	2
21st.....	3¼	2

The number of the chevron bones is fourteen; but from the corresponding vertebral facets one would believe them to have been originally fifteen. The first and second have moderate-sized laminæ; a sharp-edged keel, long and tapering in front, shorter and more rounded behind; both processes more produced in the first bone. The third, fourth, fifth, and sixth are considerably larger, each somewhat oblong in shape, their depth being greatest; the antero-posterior projections not prominent. In the seventh the laminæ are very much stronger and thicker, the articulating facets of great breadth, considering the size of the bone. In the eighth, ninth, and tenth there is a slight return to the shape of the first and second. The laminæ, however, are broader in comparison with these last: the keel is roughened at the junction with the laminæ; at the same time it is thinner, deeper, and shaped not unlike the sternum of a bird, sharp pointed in front; it is not so long and tapering as in the two first; the posterior projection likewise is concave instead of convex. The laminæ of the eleventh and twelfth are much shorter in depth; the keel processes not prominent, although the bones are longest in this diameter. On the whole, they are solidified, and of an opposite oblong form to the third, fourth, fifth, and sixth. The thirteenth and fourteenth bones diminish much in size, but they are thicker in proportion; they approach the triangular in figure; the front articulations are very long and sloping, and these occupy the greater part

of the upper and anterior surfaces. The keel in both is very thick, in the fourteenth grooved on its under edge.

The following numbers represent, in inches, the greatest vertical and horizontal diameters of the whole of these chevron bones :—

	Greatest height.	Greatest length.
First	9½	13¾
Second	9¾	9¾
Third	12	10¼
Fourth	11½	10
Fifth	10½	10
Sixth	9	11
Seventh	10	10
Eighth	10	8
Ninth	9	8
Tenth	8	7½
Eleventh	7	7¾
Twelfth	6	7¼
Thirteenth	5½	6
Fourteenth	3½	5½

There are fifteen ribs on either side ; they pass by a series of graduated changes in thickness, breadth, and curve from the first to the fifteenth.

The general form of the first, looking upon its broad surface, is that of a slightly unequal arch. From its indistinct angle it makes a short quick turn towards the head, while the sternal end slopes with a wide bend to form the opposite longer limb of the arch. The head and sternal ends have each a slight twist inwards and backwards ; so that although nearly flat, the whole rib is not entirely in a vertical plane. The head itself is simple, somewhat roundish, broad, and undivided (fig. 4, no. 1). The articular surface extends the whole length of the broad terminal edge. There is a wide groove between the tuberosity and rudimentary angle. The sternal end of the rib is broadened and terminally truncated.

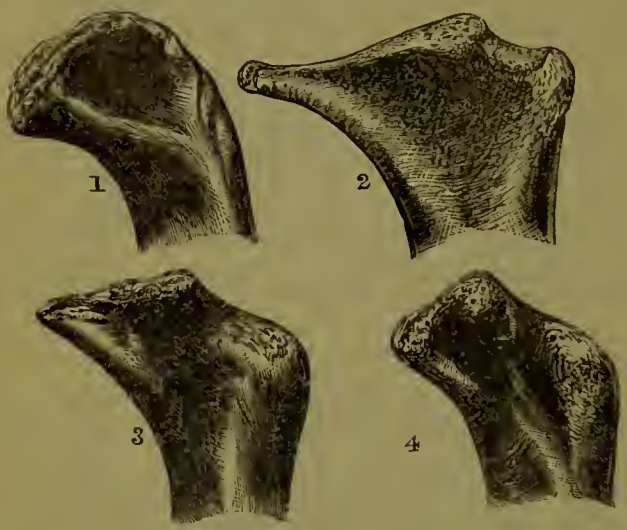
Specimens of the first rib of this species hitherto described differ from each other in the development of the capitular process. The Rosherville and Antwerp specimens* have the head rounded and broad ; the specimen at the Alexandra Park and another lately exhibited near the Eastern Counties Railway, but now in the possession of the College of Surgeons, have, on the other hand, the process developed to a remarkable extent.

In the second rib the head is somewhat triangular in shape, terminating inwards in an elongated beak-like capitular process ; the whole set at right angles to the long diameter of the body of the rib (fig. 4, no. 2). Its entire upper surface forms the articulating surface, which is concave. The tuberosity is well marked, as also the angle of the rib. The body of this rib is almost a third longer than the

* W. H. Flower, "On the Skeletons of Whales in the Museums of Holland and Belgium," Proc. Zool. Soc. 1864, p. 415.

first one, and it makes a long sweeping curve which terminates in a tapering manner, truncated, however, at the very extremity; the lower portion is twisted forwards from the general plane of the rib. The second rib, unlike the first, appears to be pretty constant in shape in different individuals.

Fig. 4. *Heads of the first four ribs.*



The outlines of the heads of the first and second ribs of *Benedenia knoxii*, figured by Dr. Gray (P. Z. S. 1864, p. 214, fig. 8 *b*, 1, 2), are very like those of this Rosherville specimen. In *Megaptera* (p. 210, fig. 7 *a*) and in *Sibbaldius* (p. 224, figs. 16, 17, 18), however, they are quite characteristic of the genus.

The body of the third rib is on the whole much the same as the second, except that the sternal extremity tapers more gradually. The capitular process, so marked in the second, is here shortened, the head becoming rhomboidal in shape (fig. 4, no. 3). The articulating surface is not so extensive, and the tuberosity is less prominent; the angle is at a greater distance from the vertebral extremity, and the neck is more marked. The fourth rib follows the general pattern of the second and third; but the head alters more in a line with the body (fig. 4, no. 4). The articulating surface is shorter, more vertically placed, and less pointed below and within; the angle is more bulky, but not so sharp. The sternal tapering end is enlarged in width, and it has an increased backward curve.

The fifth is narrower, but very similar to the fourth. The angle increases in distance, but is less acute. The sternal extremity is considerably bent inwards towards the cavity of the thorax. The sixth and seventh decrease in width; otherwise the curves are very similar to the fifth. The eighth, ninth, and tenth agree pretty much with each other; the body becomes more rounded. The angle nearly disappears in the eleventh. The twelfth is like the eleventh, but

more slender. The thirteenth is compressed from before backwards. The fourteenth is thinner and more delicate, though almost as broad as the three ribs that go before it; it is not ridged, but there is a slight break in the posterior border of the upper curve (as likewise in the thirteenth), which in the next or last rib takes a backward arch.

The fifteenth, like the first and second, has individual peculiarities. The body of the rib is well developed, and not much shorter than the fourteenth and the others in advance. It has a roundish head; and the neck is so twisted that what is the outer surface in the ribs before it, here comes to look backwards; and at this part it is flattened. There is no angle. The upper third of the body is bent in an arched form backwards and slightly outwards; then the rib broadens and flattens, while the backward arch is reversed forwards, forming in the middle a wide anterior sweep, which, as it approaches the free abdominal extremity, curves again backwards, tapering to a falciform termination. The rib has thus three grand curves and twists, giving it a remarkable, sinuous character.

The accompanying table shows at one view the relative proportions of the ribs on one side; and in this manner the peculiarities of each are well demonstrated.

Ribs.	Greatest length following outer border of arch.	Greatest length in a straight line.	Diameter of chord.	Greatest breadth of head.	Breadth of neck.	Breadth about the middle of rib.	Breadth of free point.
1st.....	53	43	10	6	5	4½–5	5¾
2nd	68	61	16	9½	6	4½–5	3¼
3rd	82	72	17	6	5	4¼–5½	4
4th	88	78	..	5	4½	5 –4	3½
5th	90	80	23	4½	3¾	4½–3½	3¾
6th	91	80½	24	3¾	3	3½–4	3
7th	92	81	..	4	3	3 –3½	3
8th	89	80	16½	4	2⅔	3 –2½	2½
9th	86	77	15½	3¾	3	3½	1½
10th	..	75	..	4	2⅓	3 –2⅓	1½
11th	..	72	..	4	2¼	3 –2¼	1¼
12th	..	65	..	2½	2	3½–2¼	1¼
13th	..	63	..	2¼	2	2¾–2¼	1¼
14th	..	63	..	..	..	..	..
15th	..	63½	..	1½	1¼	2¾	1½

The sternum is a strong solid bone, somewhat cruciform, widest transversely, with concave borders. The anterior projection is broadly rounded; the lateral projections are flatly conical; the posterior is somewhat similar, but narrower, circular, and taper-pointed. In front the central surface is slightly hollowed, the anterior and posterior processes are moderately bent forwards; so that on looking on the sternum sideways it has a concave appearance in front, with the lateral expansions thrown backwards. Its greatest length is 17″, and breadth 22″. Across the base of the anterior projection there is a breadth of 9″, of the lateral processes 5¾″, and of the posterior

5″; while the length of this last is 8″. The thickest part of the bone is as much as 2 inches. In *Physalus antiquorum* the sternum appears to vary considerably in its shape, size, and relative proportions. For example, the specimen now at the College of Surgeons is 17″ long by 21″ broad, that at the Alexandra Park 24″ long by $21\frac{3}{4}$″ in breadth, and the Antwerp specimen 24″ long by 19″ broad (Flower, *loc. cit.* p. 415).

The scapula is broad and flat, with only the rudiment of a spine, represented by a ridge which forms part of the anterior border. The base or spinal border is a long depressed arch; the anterior border is nearly straight, the posterior one more concave. The inner surface has eight diminutive ridges, spread fan-like for the attachment of the subscapularis muscle. The greatest breadth of the bone, in a direct line between the angles of the spinal border, is 47″; the length in the opposite direction, to the glenoid cavity, 27 inches. The coracoid process is acuminated and pretty solid; length 6″, basal breadth $3\frac{1}{4}$ inches. The acromion juts out in a direction almost parallel with the coracoid process and spinal border; it is 10″ long, and $4\frac{1}{2}$″ at its widest, which is towards the outer end, where it is flattened, and with a moderate bend towards the ribs. The glenoid cavity is shallow and oval-shaped; the antero-posterior diameter 10″, and the transverse 7 inches. Circumference round the neck of bone $29\frac{1}{2}$ inches.

The humerus is very thick, and oblong in shape, with a massive rounded head, at the base of which is a groove just sufficient to indicate a neck. The shaft alters little in thickness; it is flattened outwardly with a central oval depression 3 by $2\frac{1}{2}$ inches in diameter; the opposite surface of the bone has a bulky prominence. The condyles are lost in two broad articulating facets, which approach each other in a very open V-shaped manner; there is a third facet (the trochlea) in lateral juxtaposition with the olecranon process. The dimensions of the humerus are as follows:—Greatest length 19″, the same on the ulnar side 17″, and on the radial side $16\frac{1}{2}$″; greatest breadth at the head $12\frac{1}{2}$″; breadth of the narrowest portion of the shaft $9\frac{1}{2}$″, and at the lower part (condyles) $10\frac{1}{2}$″; circumference of neck $29\frac{1}{2}$″, the same at middle of shaft 25″.

The radius has a straight, smooth, compressed shaft, a little widened at either extremity; the head and neck are not well defined. Its measurements are:—greatest length 30″; breadth at head $7\frac{1}{4}$″, circumference of same $19\frac{1}{2}$″; diameter at middle of shaft $5\frac{1}{4}$″, circumference of same $13\frac{1}{4}$″; diameter of shaft at lower extremity $17\frac{1}{4}$″, circumference of same $17\frac{3}{4}$″.

The ulna, like the radius, is compressed both in the shaft and extremities, but most considerably at the lower end. The olecranon is prominent, and placed laterally and posteriorly to the shaft of the bone; it has a flattened semilunar shape. In greatest breadth the ulna is 32″; the circumference at the neck of the shaft $13\frac{1}{2}$″; the diameter at the middle of the shaft is 4″, the circumference of the same $10\frac{3}{4}$″; width at the lower extremity 6″, circumference of same 14″. The greatest length of the olecranon process, taken diagonally,

is 9″; the outer side of the same, parallel with the diameter of the shaft, 6″, and the outer curve of the same process 10″. Breadth of the olecranon at middle 4″; the same tangentially at the neck and its circumference 15″.

The five carpal bones have a very considerable thickness in relation to their breadths, and each has five articulating facets. The comparative superficies of three of these taken separately are, of one of them in length and breadth $3\frac{1}{2}$″ by 3″, thickness $1\frac{1}{2}$″; of a second 3″ by 3″ in diameter, and $2\frac{1}{2}$″ thick; of the third 3 by 2″, and $2\frac{1}{2}$″ thick. The metacarpal bones and phalanges are so imperfect and badly mounted that no dependence can be placed either on their number or position.

The hyoid bone presents no marked divergence from the shape usual in *Physalus*. The body is compressed and with an anterior convexity. The anterior cornua are W-shaped, and with a moderate-sized notch, which is more pointed and narrower than in *Sibbaldius*. The thyrohyals are large, and thrown backwards from the body as much as 8 inches at their tips; they are thickest at their middle, and abruptly truncated at their extremities: these also differ from those of *Sibbaldius* both in general thickness and in the direction in which they are produced from the body of the bone. The measurements of the hyoid are the following:—Greatest width in a straight line 34″, and following the outer curve 39″; greatest length from before backwards $10\frac{3}{4}$″. Length of body to fork of cleft $7\frac{1}{2}$″; breadth of the body 6″. Small or anterior cornua, in length $3\frac{1}{4}$″. Greater cornua (thyrohyals), breadth tangentially at the roots 6″; circumference at same 13″, and at their tips 9″. The whole bone is light in comparison with its size.

The pelvic bones are wanting.